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(19) Japan Patent Office (JP)

(12) **PUBLICATION OF UNEXAMINED PATENT APPLICATION** (A)

(11) Unexamined Patent Application Publication No.: H5-138531

(43) Publication Date of Unexamined Patent Application: June 1, 1993

| (51) Intl. Cl[5] | | ID Code | Internal File No(s) | F1 | Technical Exhibit Section |
|---|---|---|---|---|---|
| B24B | 49/12 | | 9135-3C | | |
| | 19/08 | Z | 7234-3C | | |
| | 27/00 | A | 7908-3C | | |

Request for Examination: Not made No. of Claims: 1 (Total of 4 pages)

| | | | |
|---|---|---|---|
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| (22) Application Date | November 21, 1991 | (72) Inventor | Kensuke Ide<br>3-2-1, Gion, Asaminami-ku, Hiroshima-shi, Hiroshima Prefecture<br>c/o Mitsubishi Heavy Industries, Ltd., Hiroshima Machinery Works |
| | | (74) Representative | Toshiro Mitsuishi, Patent Attorney (and 1 other) |

(54) Title of the Invention: Grinding Apparatus

(57) [Abstract]

[Object] To ensure that waste-free and thorough grinding is performed with a die grinding apparatus.

[Configuration] An apparatus in which a configuration is provided that will determine the luster in the vicinity of a grinding tool 4, compare it to the luster setting that has been selected, and give instructions for the resumption of grinding if the luster is imperfect.

[see source for diagram]

[callouts:]

8—Resume-grinding command device
7—Luster setting device
6—Luster tester
2—Robot body
4—Grinding tool
5—Die
3—Spindle motor
1—Control device

[Scope of Patent Claims]

[Claim 1] A grinding apparatus wherein there is contained a means to determine the luster of the substance to be ground, a means to set the desired luster, and a means to compare the determined luster that is determined, as mentioned above, with the luster that has been designated and resume grinding until the desired luster is obtained, in a device that performs grinding by causing a grinding tool to travel along a preprogrammed pathway.

[Brief Explanation of the Invention]

[0001]

[Industrial Field of Application] The present invention relates to a cutting apparatus for robots that grind stamping dies.

[0002]

[Prior Art and its Problems] By way of illustration, when working with a stamping die, we first cut out the shape of the die on a profiler. It is then ground by hand or by a robot to become a die with smooth surface. In this instance, in performing the grinding by robot, a robot similar to the one shown in FIG. 2 is utilized. More specifically, in FIG. 2 the control device 1 regulates the movement of each joint and arm on the robot body 2, and grinds the die 5 by traveling along a preprogrammed pathway and moving the grinding tool 4, which is rotated at the same time by the spindle motor 3.

[0003] The following problems exist with conventional methods because they do not have a means to determine the smoothness of the die surface after grinding.

1) They cannot guarantee whether grinding has been performed until the desired luster is obtained, even if all processes are completed in accordance with the program in control device 1.

2) There is, instead, a possibility that they will continue to grind and waste time despite having already obtained the desired luster.

[0004] An object of the present invention is, by taking the above problems into consideration, to provide a grinding apparatus that puts a stop to insufficiency and waste in grinding.

[0005]

[Means for Solving the Problem] The present invention that solves the above-mentioned problems is characterized in that it contains a means to determine the luster of the substance to be ground, a means to set the desired luster, and a means to compare the determined luster that is determined, as mentioned above, with the luster that has been designated and resume grinding until the desired luster is obtained, in a device that performs grinding by causing a grinding tool to travel along a preprogrammed pathway.

[0006]

[Operation] It is possible to perform grinding until the desired luster is reached, and grinding without excess or deficiency is also possible because the grinding of the area will cease when the desired luster has been achieved.

[0007]

[Embodiments] We will explain here the embodiments of the present invention by making reference to FIG. 1, FIG. 3, and FIG. 4. FIG. 1 is one embodiment, in which luster tester 6 is provided on robot body 2 facing the grinding surface. This luster tester 6 is made up of a projector 6a and a receiver 6b, as shown in FIG. 3, which are placed in opposition to each other so that together they will end up reflecting at right angles to each other with respect to the reflective surface.

In this instance the light from projector 6a is not a perfect spot of light because the grinding surface is not completely flat, and using light that has a uniform spread requires us to ensure that the one-way receiver 6b is able to focus the light from a reasonably broad band, and it is necessary, for example, to seek integral values for the amount of light received with a two-dimensional CCD camera. In the luster measurements of luster tester 6, luster is defined as the amount of light received divided by the amount of light projected, the mirror surface being designated as 1. In FIG. 3, the received light amount $\beta$/ projected light amount $\alpha$ grows larger and approaches 1, the closer the reflective surface is to the mirror surface.

[0008] At the same time, the desired luster is set by the operator with luster setting device 7. In the resume-grinding command device 8, the luster of the die surface near the tip of the grinding tool is taken in from luster tester 6 and compared to the luster coming from the luster setting device 7 at the same time as its mean values are sought. Then, in a situation where the luster from luster tester 6 is lower than the luster that is specified, it give instructions to control device 1 to continue to perform grinding of the same area. In the control device 1, resume-grinding instructions are incorporated as software and the grinding of the area is resumed if a resume-grinding instruction is issued, while the grinding area will be moved in accordance with the software when one is not issued.

[0009] FIG. 4 illustrates the operation of resume-grinding command device 8. More specifically, a flow consisting of calculations of inputs and means values for measurement data, comparisons with measured values, and resume-grinding command outputs when they are smaller than set values is implemented.

[0010] Thus, it is able to manufacture dies of uniform quality without wasted time because it will continue with the grinding until the desired luster is obtained.

[0011]

[Effects of the Invention] As we have explained above, it is able to manufacture dies of high quality without wasted time and while unattended because it will continue with the grinding, measuring the luster, until the desired luster has been obtained.

[Brief Explanation of the Drawings]

[FIG. 1] Block diagram of one embodiment of the present invention.

[FIG. 2] Block diagram of a conventional example.

[FIG. 3] Explanatory diagram of luster measurement.

[FIG. 4] Flow chart based on resume-grinding command device.

[Explanation of the Codes]

1. Control device
2 Robot body
4 Grinding tool
5 Die
6 Luster tester
6a Projector
6b Receiver
7 Luster setting device
8 Resume-grinding command device

[FIG. 1]
[see source for diagram]
[FIG. 1 callouts:]
8 resume-grinding command device
7 luster setting device
6 luster tester
2 robot body
4 grinding tool
5 die
3 spindle motor
1 control device

[FIG. 2]
[see source for diagram]
[FIG. 2 callouts]
1 control device
3 spindle motor
2 robot body
4 grinding tool
5 die

[FIG. 3]
[see source for diagram]
[FIG. 3 callouts:]
6a projector
6b receiver
received light amount $\beta$
projected light amount $\alpha$

(4)

[FIG. 4]
[see source for diagram]

START

Input measurement data
from luster tester

Calculate average for
1 area section

Compare with set values
in the luster setting device

Average value < Set value NO

YES

Input resume-grinding instruction

END

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（A）**　(11)特許出願公開番号

**特開平5－138531**

(43)公開日　平成５年(1993)６月１日

| (51)Int.Cl.[5] | 識別記号 | 庁内整理番号 | Ｆ Ｉ | 技術表示箇所 |
|---|---|---|---|---|
| Ｂ２４Ｂ　49/12 | | 9135－3C | | |
| 19/08 | Ｚ | 7234－3C | | |
| 27/00 | Ａ | 7908－3C | | |

審査請求　未請求　請求項の数１(全　４　頁)

(21)出願番号　特願平3－306047

(22)出願日　平成３年(1991)11月21日

(71)出願人　000006208
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三菱重工業株式会社広島工機工場内

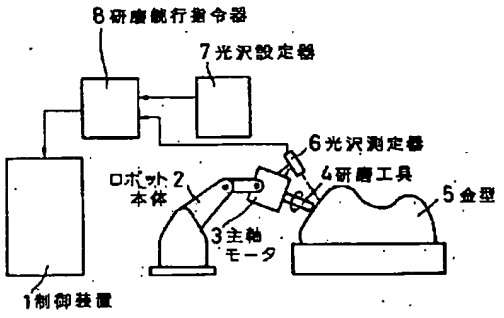
(74)代理人　弁理士　光石　俊郎　(外１名)

(54)【発明の名称】　研磨装置

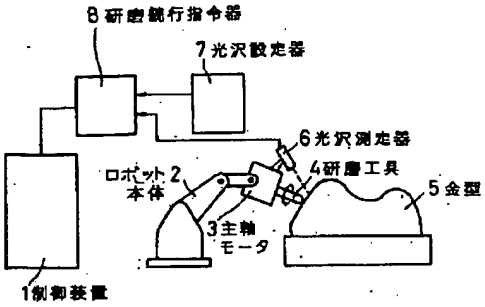
(57)【要約】

【目的】　金型研磨装置にて無駄なくかつ充分に研磨を行なうようにする。

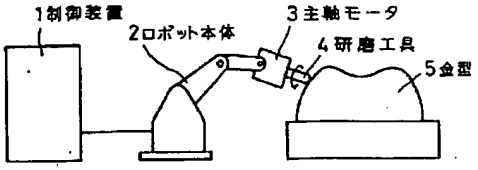
【構成】　研磨工具４付近の光沢を測定し、設定した光沢と比較し、光沢が不充分ならば研磨続行を指令する構成を備えたものである。



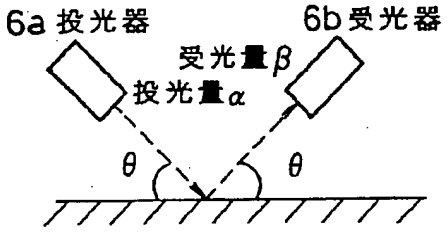
【図１】


8研磨銑行指令器
7光沢設定器
6光沢測定器
ロボット2
本体
4研磨工具
5金型
3主軸
モータ
1制御装置

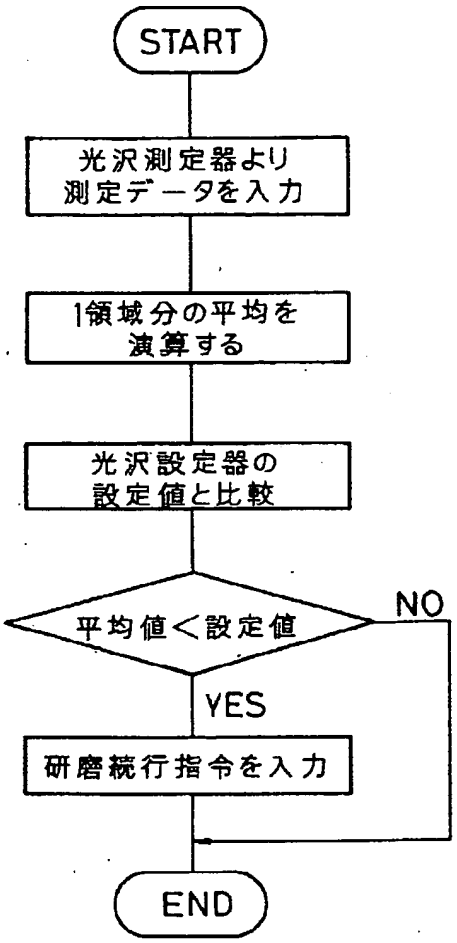
【図２】


1制御装置
2ロボット本体
3主軸モータ
4研磨工具
5金型

【図３】


6a 投光器
6b受光器
受光量β
投光量α
θ
θ

【図4】

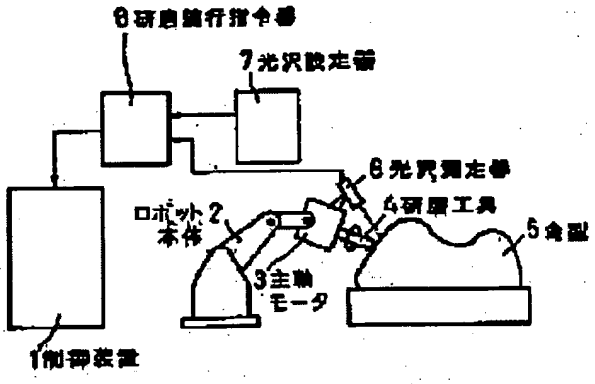

START
光沢測定器より
測定データを入力
1領域分の平均を
演算する
光沢設定器の
設定値と比較
平均値＜設定値
NO
YES
研磨続行指令を入力
END

# POLISHING DEVICE

**Patent number:** JP5138531
**Publication date:** 1993-06-01
**Inventor:** IDE KENSUKE
**Applicant:** MITSUBISHI HEAVY IND LTD
**Classification:**
**- international:** B24B49/12; B24B19/08; B24B27/00
**- european:**
**Application number:** JP19910306047 19911121
**Priority number(s):**

Abstract of **JP5138531**

PURPOSE:To carry out unmanned manufacturing of high quality metallic mold by making a measurement of the gloss of a work to be polished, and controlling the polishing movement making a comparison between the measured results and the set value.
CONSTITUTION:A gloss measuring device 6 consisting of a light emitting device and a light receiving device which are placed mutually opposite to each other relative to the relective surface is provided to a robot body facing toward a polished surface, and the gloss of a press metallic mold 4 which is a work to be polished is measured. The measured data together with the set data to be set by a gloss setting tool 7 are received by a polishing continuation command device 8. The gloss of the metallic mold surface in the vicinity of the tip of a polishing tool 4 measured by the gloss measuring device 6 is collected to obtain the average value, and a comparison is made between the average value and the set value. When the measured value is smaller than the set data, the command to continue the polishing work in the same region is outputted to a control device 1, and the polishing work of the metallic mold by the polishing tool 4 is continuously achieved.

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